

CLAIMS

1 1. A system for modifying input image data used by a projector in generating a
2 displayed image, the projector supporting number of unique levels, the system compris-
3 ing:
4 a luminance uniformity engine configured to process the input image data so as to
5 generate corrected image data that is uniform in luminance;
6 a dither engine configured to process the corrected image data from the luminance
7 uniformity engine so as to generate dithered image data; and
8 a converter configured to convert the dithered image data into the unique levels of
9 the projector.

1 2. The system of claim 1 wherein the luminance uniformity engine comprises:
2 a front-end look-up table (LUT) that imposes a gain on the input level to produce
3 a resulting input level;
4 a spatial attenuation array configured with a plurality of distortion correction val-
5 ues; and
6 a multiplier circuit for multiplying the resulting input level from the front-end
7 LUT by a selected distortion correction value from the spatial attenuation array to pro-
8 duce a luminance corrected input level.

1 3. The system of claim 2 wherein
2 the input image data includes a level and x,y coordinates for each level, and
3 the distortion correction values of the spatial attenuation array are indexed by the
4 x,y coordinates of the input image data.

1 4. The system of claim 1 wherein the dither engine comprises:
2 a dither array configured with a plurality of dither values;
3 an adder circuit configured to generate a sum by adding a selected dither value to
4 the luminance corrected input level; and

5 a shift register configured the shift the sum by a selected number of bits, thereby
6 producing a dithered output level.

1 5. The system of claim 4 wherein
2 the dither engine has a number of input levels and a number of output levels, and
3 the number of output levels of the dither engine is one of equal to and greater than
4 the number of stated levels of the projector.

1 6. The system of claim 3 wherein
2 the input image data includes a level and x,y coordinates for each level, and
3 the dither values are indexed by the x,y coordinates of the levels of the input im-
4 age data.

1 7. The system of claim 4 wherein the converter is a back-end look-up table (LUT)
2 that is configured to map dither output levels to unique projector levels.

1 8. A method for correcting projector non-uniformity and increasing apparent am-
2 plitude resolution, the projector supporting a stated number of levels, the method com-
3 prising the steps of:
4 measuring the projector non-uniformity at a plurality of the stated levels;
5 determining the number of unique levels supported by the projector;
6 utilizing the non-uniformity measurements to generate uniform projector image
7 data; and
8 dithering the modified projector image data such that a displayed image appears
9 to have been formed either from the stated number of levels or from a greater number of
10 levels than the stated number.

1 9. The method of claim 8 wherein the step of determining the number of unique
2 projector levels comprises the steps of:

3 generating a displayed image from the projector for each of the plurality of stated
4 projector levels;
5 capturing each of the displayed images with a camera, each camera captured im-
6 age having a plurality of pixel values;
7 averaging all of the pixel values for each camera captured image; and
8 comparing the averaged pixel values computed for two adjacent stated projector
9 levels to determine whether the two stated projector levels are unique.

1 10. The method of claim 9 wherein the step of comparing the averaged pixel val-
2 ues comprises the steps of:
3 computing the difference between the averaged pixel values for the two adjacent
4 stated projector levels;
5 finding the two adjacent stated projector levels to be unique provided that the
6 computed difference is greater than a threshold times the difference between a maximum
7 averaged pixel value considering all of the plurality of stated levels and a minimum aver-
8 aged pixel value considering all of the plurality of stated levels; and
9 finding the two adjacent stated projector levels to be redundant provided that the
10 computed difference is less than a threshold times the difference between the maximum
11 averaged pixel value and the minimum averaged pixel value.

1 11. The method of claim 10 wherein the threshold is on the order of 0.001.

1 12. The method of claim 8 wherein the uniform projector image data has a plural-
2 ity of corrected levels, and the step of dithering the uniform projector image data com-
3 prises the step of utilizing a selected dither template pattern to convert the corrected lev-
4 els of the uniform image data to corresponding dither output levels.

1 13. The method of claim 8 further comprising the step of mapping each dither
2 output level to a respective unique output level supported by the projector.

- 1 14. The method of claim 13 wherein the selected dither template pattern is a void
2 and cluster pattern.